



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2017-0317; Special Conditions No. 25-694-SC]

Special Conditions: Embraer S.A. Model ERJ 190-300 airplane; Flight Envelope Protection: Normal Load Factor (g) Limiting

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Embraer S.A. (Embraer) Model ERJ 190-300 airplane. This airplane will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport-category airplanes. This design feature involves flight-envelope protection functions that limit such flight parameters as, for example, angle of attack, normal load factor, attitude, bank angle, and speed during normal operation. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: This action is effective on Embraer S.A. on **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. We must receive your comments by **[INSERT DATE 45 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Send comments identified by docket number FAA-2017-0317 using any of the following methods:

- *Federal eRegulations Portal:* Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket Web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the **Federal Register** published on April 11, 2000 (65 FR 19477-19478).

Docket: Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Joe Jacobsen, FAA, Airplane and Flight Crew Interface Branch , ANM-111, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, Washington 98057-3356; telephone 425-227-2011; facsimile 425-227-1320.

SUPPLEMENTARY INFORMATION:

The substance of these special conditions has been subject to the notice and comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, because a delay would significantly affect the certification of the airplane, the FAA has determined that prior public notice and comment are unnecessary and impracticable.

In addition, since the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received, the FAA finds it unnecessary to delay the effective date and finds that good cause exists for adopting these special conditions upon publication in the **Federal Register**.

The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On September 13, 2013, Embraer applied for an amendment to Type Certificate No. A57NM to include the new Model ERJ 190-300 airplane. The Model ERJ 190-300 airplane, which is a derivative of the Embraer Model ERJ 190-100 STD airplane currently approved under Type Certificate No. A57NM, is a 97- to 114-passenger transport-category airplane. The maximum take-off weight is 124,340 lbs (56,400 kg).

Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.101, Embraer must show that the Model ERJ 190-300 airplane meets the applicable provisions of the regulations listed in Type Certificate No. A57NM, or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Model ERJ 190-300 airplane because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Model ERJ 190-300 airplane must comply with the fuel-vent and exhaust-emission requirements of 14 CFR part 34 and the noise-certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.101.

Novel or Unusual Design Features

The Embraer Model ERJ 190-300 airplane will incorporate the following novel or unusual design feature: Flight-envelope protection functions that limit such flight parameters as, for example, angle of attack, normal load factor, attitude, bank angle, and speed during normal operation.

The Model ERJ 190-300 airplane incorporates normal load-factor limiting on a full-time basis, which prevents the pilot from exceeding the positive or negative airplane limit load factor. The application of this load-factor limiting function affects airplane-handling characteristics and may compromise the airplane's maneuverability and controllability. The current regulations do not contain adequate safety standards for these novel protection features.

Discussion

The Embraer Model ERJ 190-300 design has a complex, fully digital flight-control system, referred to as fly-by-wire (FBW) architecture. This FBW architecture provides closed-loop flight-control laws and multiple protection functions.

Airplanes with conventional flight-control systems (mechanical linkages) are limited in the pitch axis only by the elevator surface area and deflection limit. The elevator-control power is normally derived for adequate controllability and maneuverability at the most critical longitudinal pitching moment. The result is that, for traditional airplanes, maneuverability in excess of limit structural design values, within a significant portion of the flight envelope, is possible.

Part 25 does not specify requirements or policy for demonstrating maneuver control that imposes any handling-qualities requirements beyond the design limit structural loads. Nevertheless, the availability of this excess maneuver capacity, in the event of extreme emergency such as upset recoveries or collision avoidance, is recognized.

These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Applicability

As discussed above, these special conditions are applicable to the Embraer Model ERJ 190-300 airplane. Should Embraer apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, these special conditions would apply to that model as well.

Conclusion

This action affects only a certain novel or unusual design feature on one model of airplane. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for Embraer Model ERJ 190-300 airplanes.

1. Normal Load Factor (g) Limiting. To meet the intent of adequate maneuverability and controllability required by § 25.143(a); and in addition to the requirements of § 25.143(a), and in the absence of other limiting factors, the following special conditions apply, based on § 25.333(b):

- a. The positive limiting load factor must not be less than:
 - i. 2.5 g for the normal state of the electronic flight-control system with the high-lift devices retracted up to V_{MO}/M_{MO} . The positive limiting load factor may gradually be reduced to 2.25 g above V_{MO}/M_{MO} .
 - ii. 2.0 g for the normal state of the electronic flight-control system with the high-lift devices extended.
- b. The negative limiting load factor must be equal to or more negative than:
 - i. Minus 1.0 g for the normal state of the electronic flight-control system with the high-lift devices retracted.
 - ii. 0.0 g for the normal state of the electronic flight-control system with high-lift devices extended
- c. Maximum reachable positive load factor, wings level, may be limited by the characteristics of the electronic flight-control system or flight-envelope protections (other than load-factor protection), provided that:
 - i. The required values are readily achievable in turns, and
 - ii. Wings-level pitch-up is satisfactory.
- d. Maximum achievable negative load factor may be limited by the characteristics of the electronic flight-control system or flight-envelope protections (other than load-factor protection), provided that:

i. Pitch-down responsiveness is satisfactory, and

ii. From level flight, 0g is readily achievable, or alternatively, a satisfactory trajectory change is readily achievable at operational speeds.

For the FAA to consider a trajectory change as satisfactory, the applicant should propose and justify a pitch rate that provides sufficient maneuvering capability in the most critical scenarios.

e. Compliance demonstration with the above requirements may be performed without ice accretion on the airframe.

f. These special conditions do not impose an upper bound for the normal load-factor limit, nor do they require that the limiter exist. If the limit is set at a value beyond the structural design limit maneuvering load factor n of §§ 25.333(b), 25.337(b), and 25.337(c), then there should be a very obvious positive tactile feel built into the controller so that it serves as a deterrent to inadvertently exceeding the structural limit.

Issued in Renton, Washington.

Victor Wicklund,
Manager, Transport Standards Branch,
Aircraft Certification Service.

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